

Indian Statistical Institute
Computer Science I (Programming in C)
First Year Students
14 September 2012

Maximum time: Three hours

Answer Any Four questions. Total Marks: 80

Note 1. Please write neatly and legibly for a code or a piece of a code to be readable.

Note 2. Unless specified otherwise, the only header file you can use is `stdio.h`.

Note 3. Please provide adequate comments in the program that you write

Note 4. For full credit your program must compile and run and give desired result

Question 1: [Total Marks 20]

For Questions 1a to 1c, Why will be the output of the following codes? (3x5=15)

1a.

```
#include <stdio.h>
main()
{
int a,b,c;
a=b=c=1;

for (a=1;a<6;a++) {
for (b=1;b<a;b++) {
for (;c<b;c++ ) {

printf("a=%d\tb=%d\tc=%d\n",a,b,c);
    }
    }
}
}
```

1b.

```
#include <stdio.h>
main() {
int a,b,c;
a=b=c=1;

for (a=1;a<6;a++) {
for (b=1;b<6;b++) {
for (;c<b;c++ ) {

printf("a=%d\tb=%d\tc=%d\n",a,b,c);
    }
    }
}
}
```

1c.

```
#include <stdio.h>
void e(int);
int main(void) {
int a = 3;
e(a);

putchar('\n');
return 0;
}
```

```

void e(int n)
{
    if (n > 0)
    {
        e(--n);
        printf("%d ", n);
        e(--n);
    }
}

```

1d. What mathematical function of x and n will the following function compute? (5 marks) Justify your answer.

```

int fun(int x, int n)
{
    int val = 1;

    if (n > 0)
    {
        if (n % 2 == 1)
            val *= x;

        val *= fun(x * x, n / 2);
    }
    return val;
}

```

Q2.[Total Marks 20] Find (and if possible correct) the mistakes in each of the following four blocks of statements

2a.

```

int *ptr , m = 100 ;
ptr = m ;

```

2b.

```

int * ptr , m = 100 ;
*ptr = m ;

```

2c.

```

int *ptr,m;
ptr = &m;

```

2d.

```
char str1[10],str2[10];
    char *ptr1 = str1;
    char *ptr2 = str2;
    if(ptr1>ptr2) {
}
-----
```

Q2e. The following code counts the number of elements that are nonzero and stops when a zero is found, assuming that there is a zero. Rewrite the program using pointers.

```
#include <stdio.h>

int array[] = {4, 5, 8, 9, 8, 1, 0, 1, 9, 3};
int indx;

int main()
{
    indx = 0;
    while (array[indx] != 0)
        ++indx;

    printf("Number of elements before zero %d\n",
           indx);
    return (0);
}
-----
```

QUESTION 3 [Total Marks 20]:

a. Provide a recursive implementation of the function

```
int gcd(int,int);
```

that computes the greatest common divisor of two integers [Hint: use the fact that for two integers m and n, $\text{gcd}(m,n)=\text{gcd}(n,m \bmod n)$]

b. Use the above function and the fact that the triplet $m^2 + n^2$, $m^2 - n^2$, $2mn$ form a Pythagorean triplet, to write a C program that generates all the Pythagorean triplet below 1000 which have no common factor other than 1. The output of the program should look like this.

```
3    4    5
5    12   13
```

etc.

QUESTION 4:[Total Marks 20]
(You can use math.h for this question)

Starting from

```
struct point {  
float x;  
float y;  
};
```

- a.) Define a structure for a triangle as a collection of three points.
- b.) Define a function **float side(struct point pt1,struct point pt2)** that gives the distance between two points.
- c.) Use the function in b) to define another function **int equilat(struct triangle t1)** that will return 1 if a triangle is equilateral and zero if it is not.
- d.) Write a complete C program which will decide if a triangle with vertices (0,0), (20,0), (10,17.3) is equilateral or not (The scale is 1 unit = 1 cm. For the purpose of this program, a triangle is equilateral if their lengths are equal to each other within 0.002 cm which is roughly the thickness of a human hair.)

QUESTION 5: [Total Marks 4+4+12]

- a.) Define two arrays of characters each having 26 members. The first array is called upper and contains all upper case letters. The second array is called lower and contains all the lower case letters.
 - b.) Write a C program using these arrays to transform an input stream to an output stream with all upper case. **You CANNOT USE the header file ctype.h and function or macros defined there. Also do not assume that the alphabets are represented by consecutive numbers in the character set.**
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